The National Academies of
SCIENCES • ENGINEERING • MEDICINE

What is needed to make EVs available to all buyers, especially in the used market, and for low-income drivers?

Electric Vehicles Workshop
October 28, 2021

Gil Tal
gtal@ucdavis.edu

UCDAVIS
PLUG-IN HYBRID & ELECTRIC VEHICLE RESEARCH CENTER

ITS UCDAVIS
INSTITUTE OF TRANSPORTATION STUDIES

Electrification equity goals

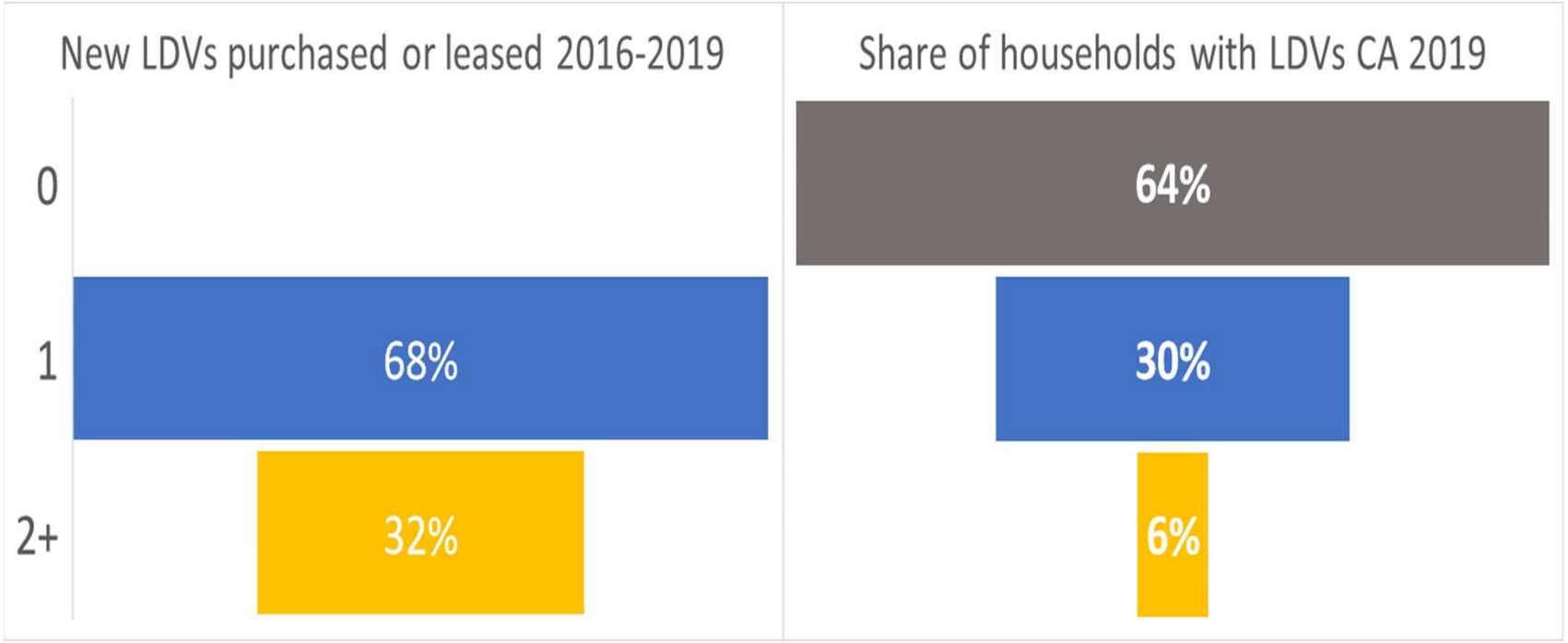
LDV privately owned discussion

- Make EVs available to all buyers
- Share of public funding
- Environmental benefits

- Community level discussion
- Household level discussion

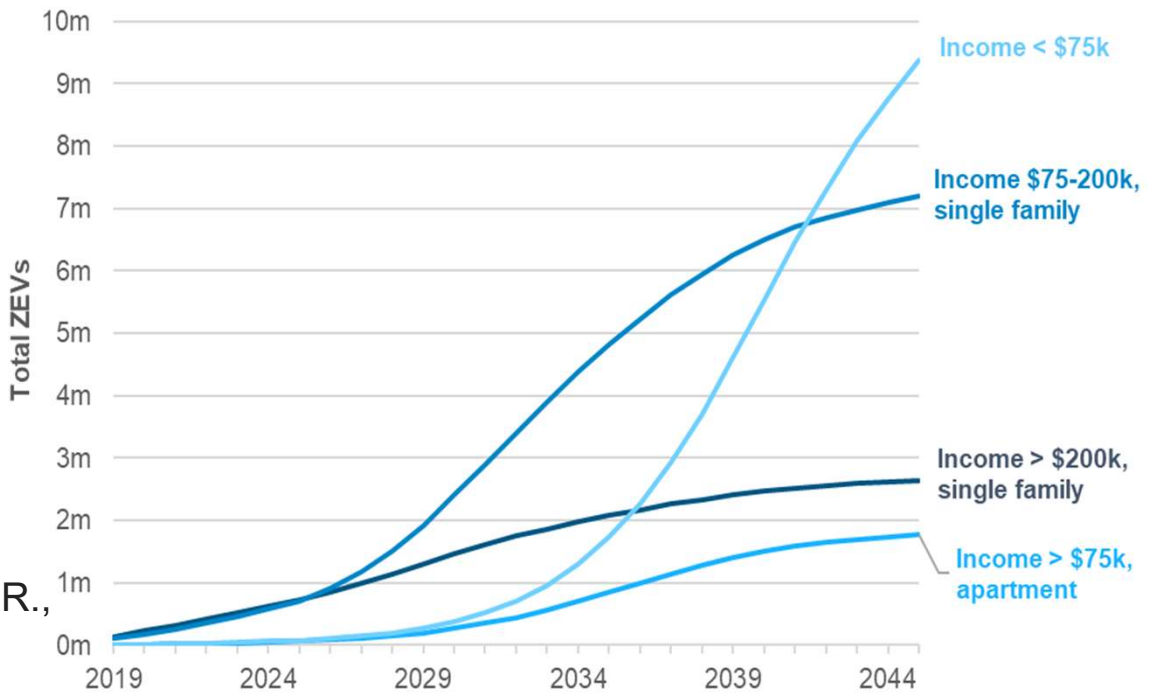
Who purchased new light-duty vehicles?

California 2016-2019



In California, Low Income households will start having high numbers of EVs in less than 10 years

- What is the impact of accelerating the transition on society?
  - Low income communities
  - Used car buyers
  - EV ownership for high electricity price users
- Changing the incentive policies
  - Income limits
  - Used EV incentives
  - Paradigm shift from incentives to change purchase preference to TCO equalizer



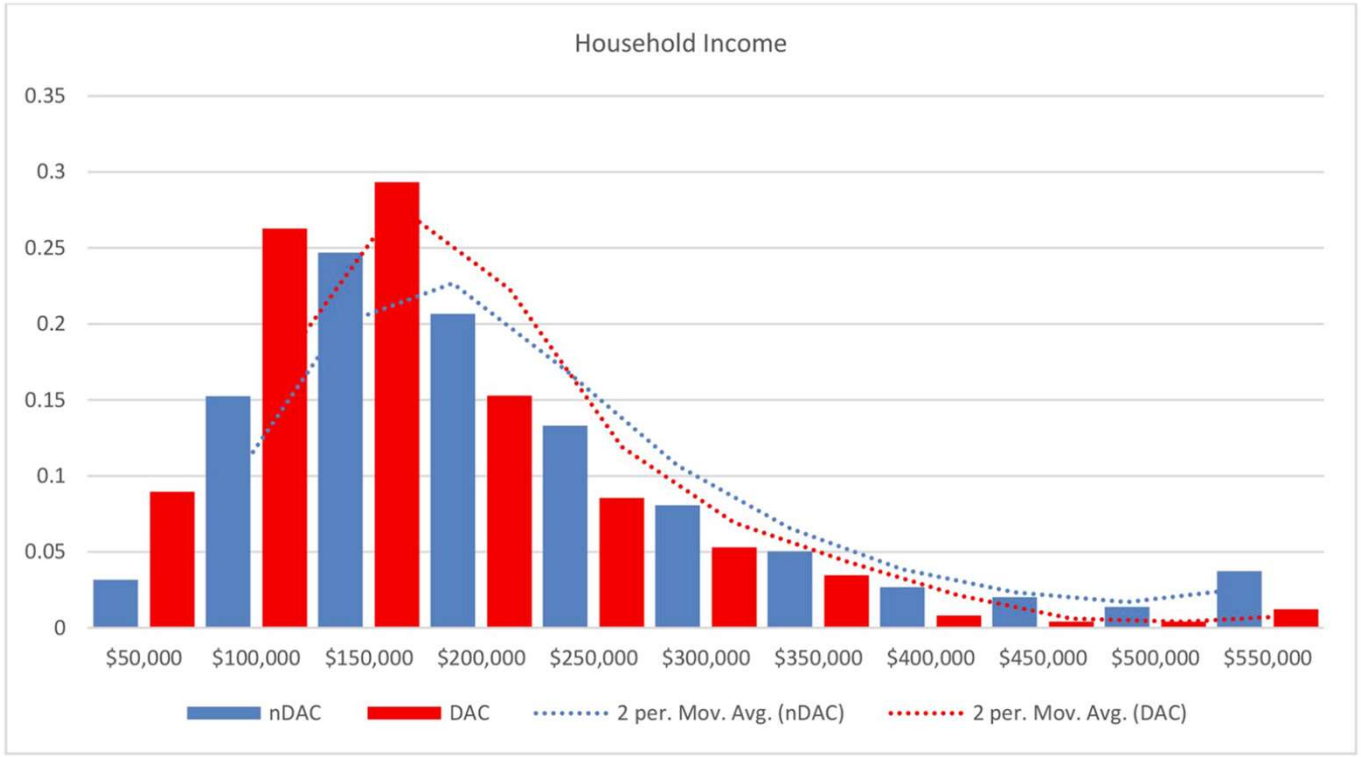
Brown, A. L., Sperling, D., Austin, B., DeShazo, J. R., Fulton, L., Lipman, T., ... & Tal, G. (2021). Driving California's Transportation Emissions to Zero.

New and Used PEVs in Disadvantaged Communities (DACs) In California

- Disadvantaged Communities (DACs), are census tracts in California that suffer from a combination of economic barriers and environmental burden.
- We Geolocate 9,400 used PEV households to DAC and Non-DAC census tracts for
  - Tesla
  - All other BEVs
  - PHEVs
- We split NEW PEV(N=178,554) households to the same categories

Canepa, K., Hardman, S., & Tal, G. (2019). An early look at plug-in electric vehicle adoption in disadvantaged communities in California. *Transport Policy*, *78*, 19-30.

Household income across DACs and non-DACs for new PEV owners



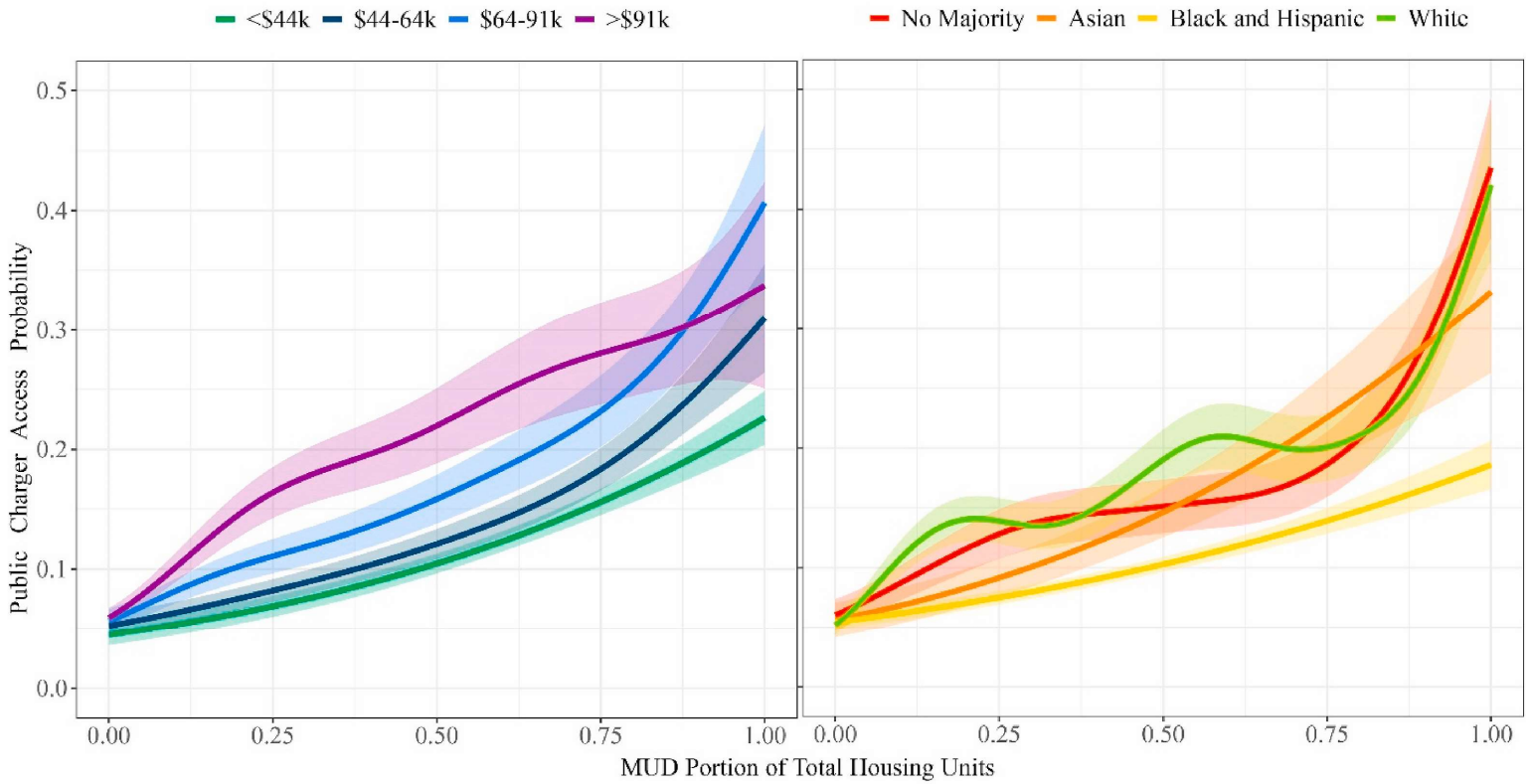
PEV Market By Community Type

	non_DAC	DAC
% census tract	75.21%	24.79%
% HH	78.66%	21.34%
% HH under 50k	69.63%	30.37%
% HH under 75k	71.95%	28.05%
% HH over 100k	90.28%	9.72%
% New PEV	93.83%	6.17%
% New BEV	93.96%	6.04%
% New PHEV	92.76%	7.24%
% New Tesla	96.39%	3.61%
% New Other BEV	93.03%	6.97%
% Used PEV	91.27%	8.73%
% Used BEV	92.01%	7.99%
% Used PHEV	90.83%	9.17%
% Used Tesla	96.01%	3.99%
% Used Other BEV	91.07%	8.93%

PEV Market By Community Type

	non_DAC	DAC
% census tract	75.21%	24.79%
% HH	78.66%	21.34%
% HH under 50k	69.63%	30.37%
% HH under 75k	71.95%	28.05%
% HH over 100k	90.28%	9.72%
% New PEV	93.83%	6.17%
% New BEV	93.96%	6.04%
% New PHEV	92.76%	7.24%
% New Tesla	96.39%	3.61%
% New Other BEV	93.03%	6.97%
% Used PEV	91.27%	8.73%
% Used BEV	92.01%	7.99%
% Used PHEV	90.83%	9.17%
% Used Tesla	96.01%	3.99%
% Used Other BEV	91.07%	8.93%

Public chargers at MUDs are not available for low income households



Hsu, C. W., & Fingerman, K. (2021). Public electric vehicle charger access disparities across race and income in California. Transport Policy, 100, 59-67.

Level 2 and DC fast charger for low income communities

Over night Level 2 charging

Pros:

- Low cost to install and per kwh
- No need to travel for charging
- Start the day with 100%

Cons:

- Need to be ¼ mile from home (utilization rate vs. dependability)
- Control over price and reliability

DC Fast Charging

Pros:

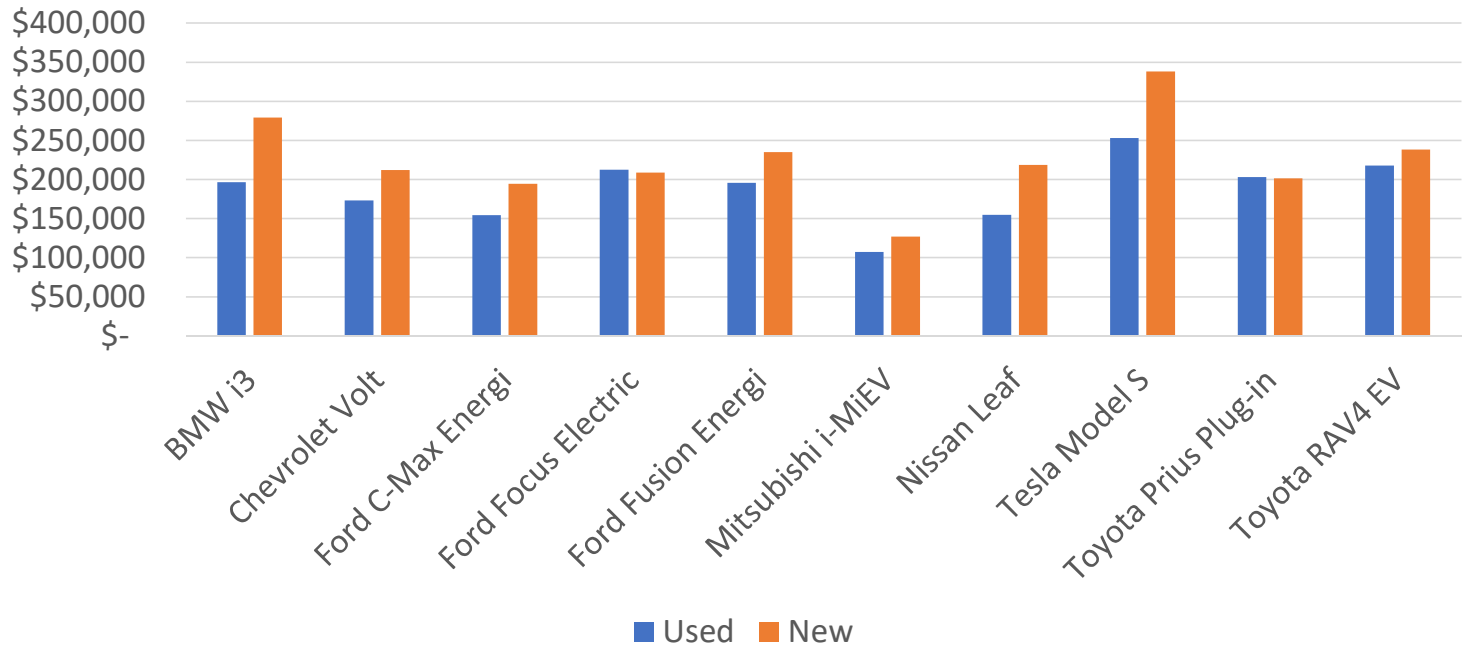
- Can serve a large geographic area
- High utilization rate

Cons:

- Installation cost, operation cost
- Charge to 80% only
- Slow charging for older and lower cost vehicles
- Higher battery degradation

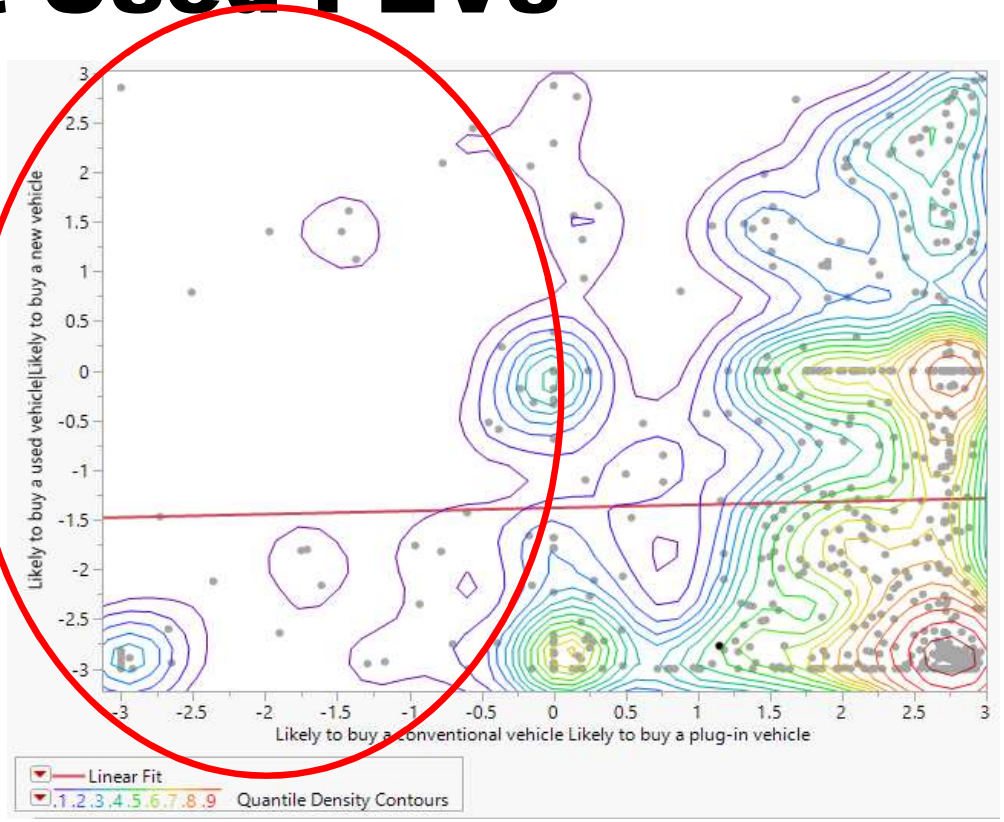
Charger Gentrification: Chargers installed in a disadvantaged community but being used by high income users from the community or other locations

Household Income of New and Used Buyers

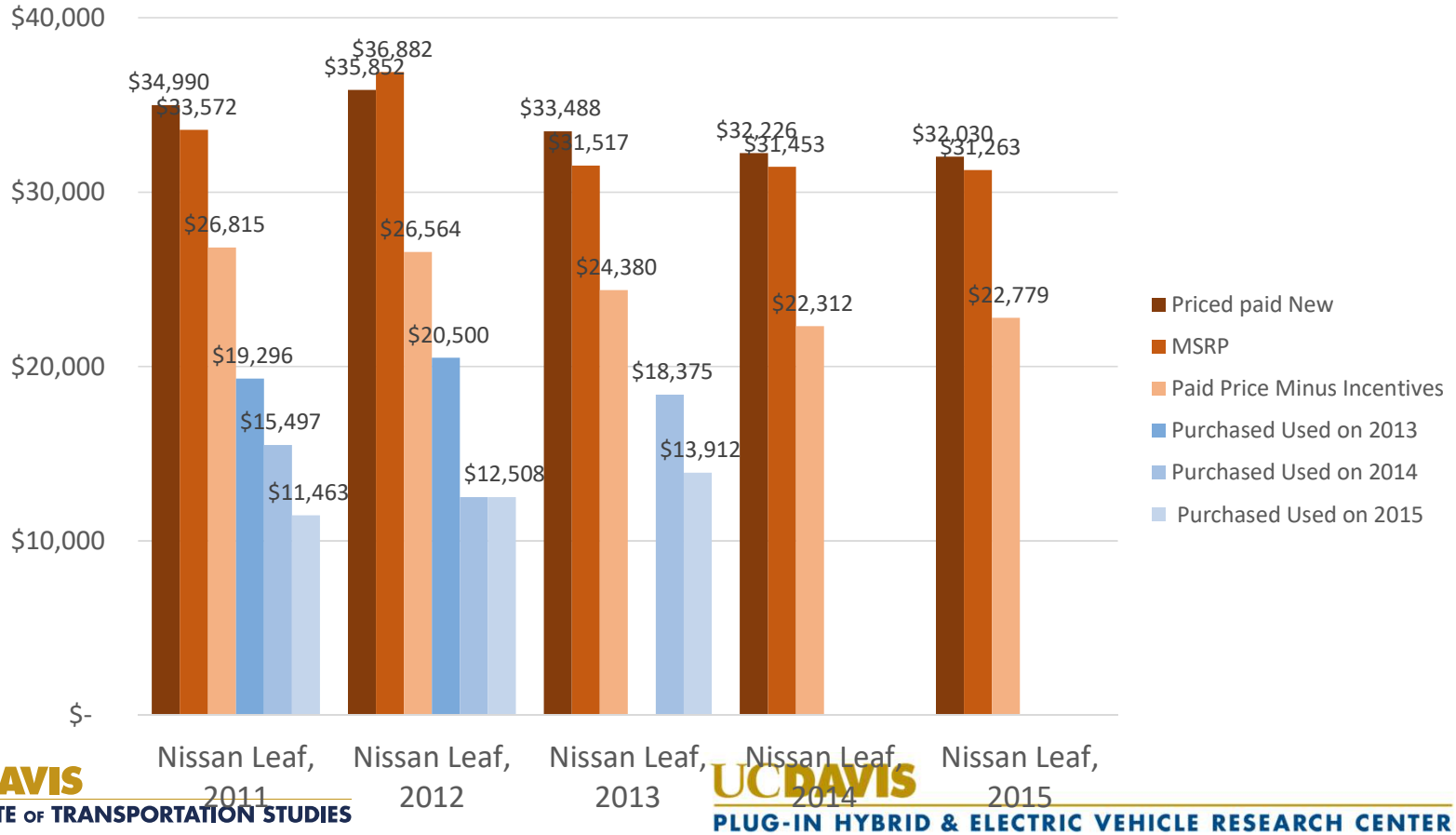


Tal, G., Nicholas, M. A., & Turrentine, T. S. (2017). First Look at the Plug-in Vehicle Secondary Market.

No Potential Buyers Of ICEs Who Bought Used PEVs

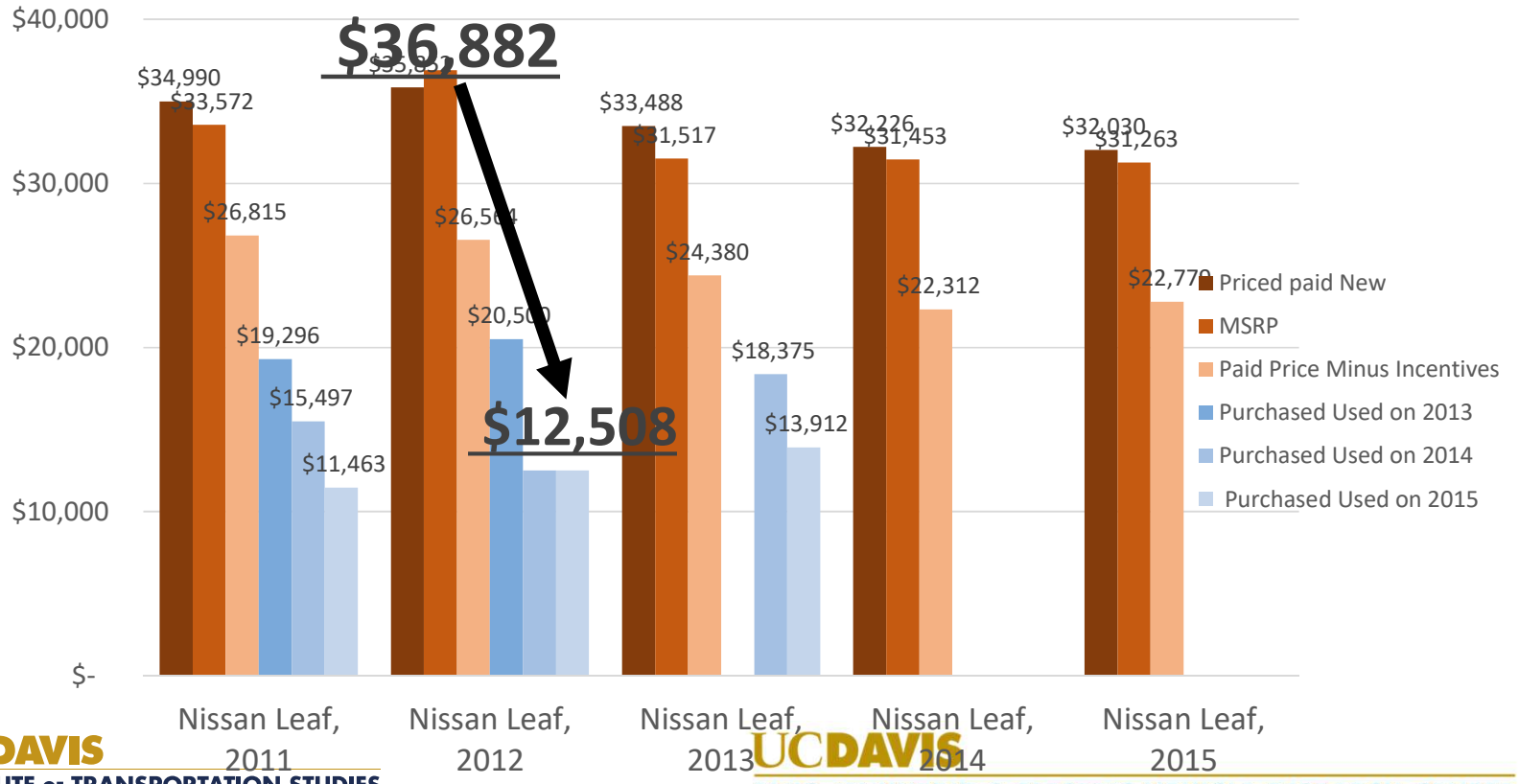


Price by Model Year and Purchase Year

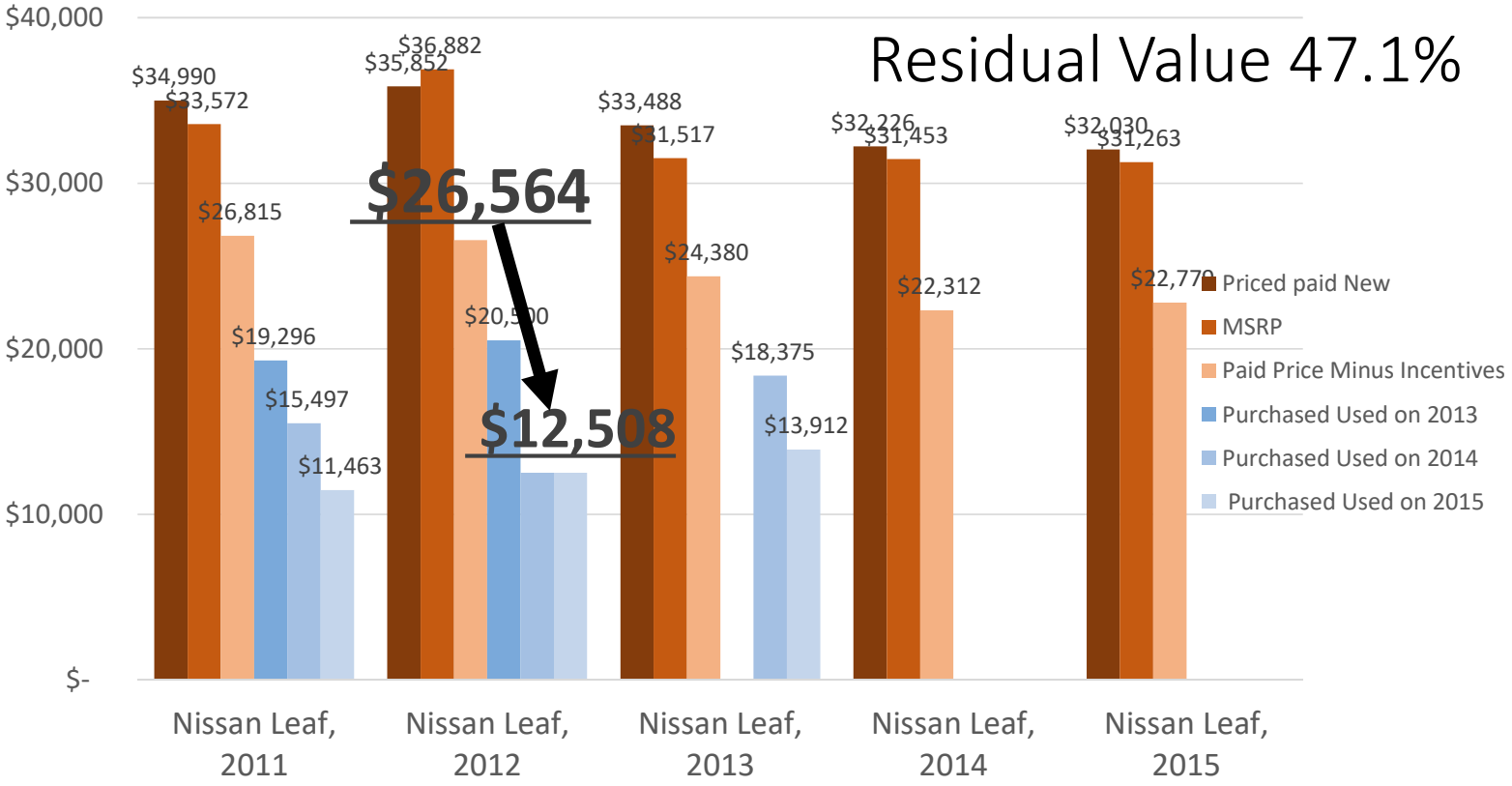


2012 LEAF Sold in 2015: The OEM Perspective

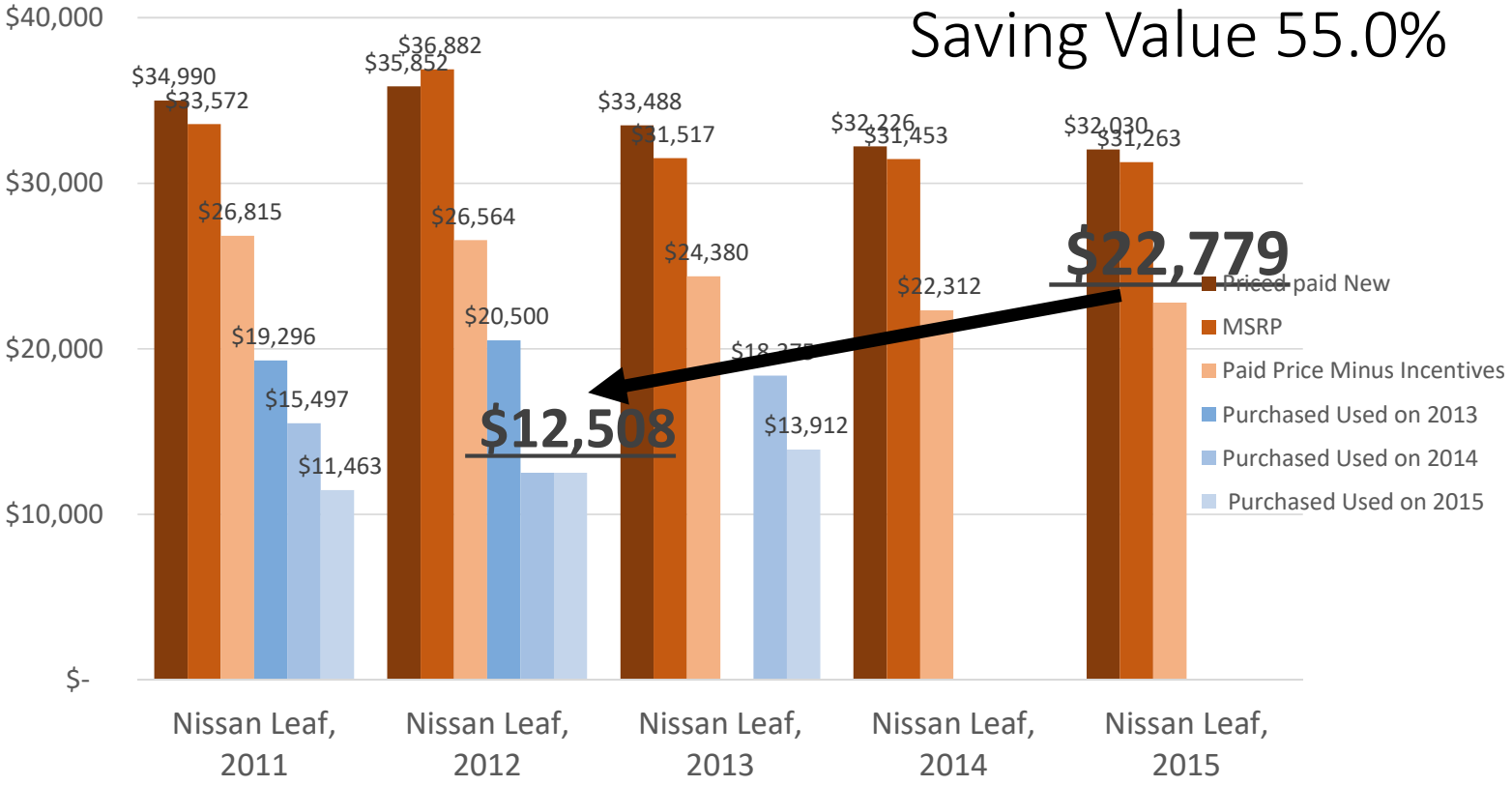
Residual Value 33.9%



2012 LEAF Sold in 2015: The Seller Perspective



2012 LEAF Sold in 2015: The Buyer Perspective



Used PEVs For low income buyers

Pros

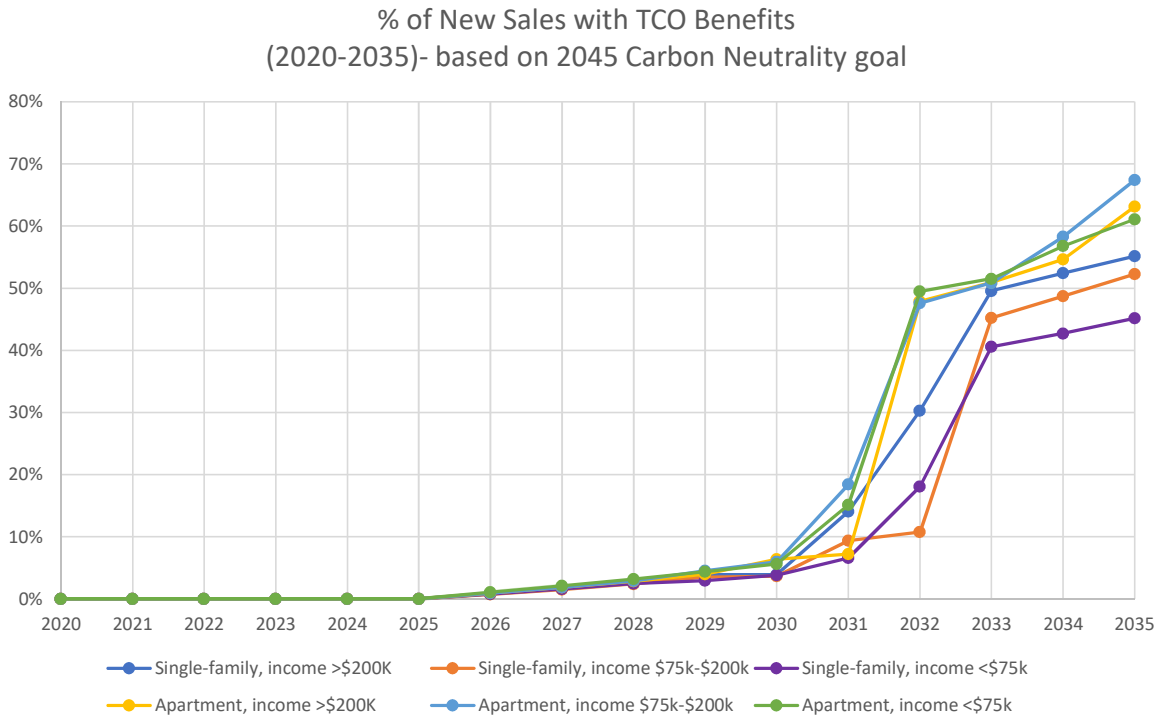
- Lower cost (save on the new car depreciation)
- Relatively new (many cars coming out from lease)
- Low cost per mile (compared to most ICEs)
- Lower cost of routine maintenance

Cons

- New technology, unknown reliability
- High cost of repair in case of major failure (battery and any big issue, no local parts and expertise).
- Charging cost, access, and reliability
- Range limitations

Share of households with TCO benefits in six segments

In the 2020-2035 period, as with the capital cost benefits, acceleration of PEV adoption may result in lower percentage of population enjoying TCO benefits from switching to new PEVs



Chakraborty, D., Buch, K., & Tal, G. (2021). Cost of Plug-in Electric Vehicle Ownership: The Cost of Transitioning to Five Million Plug-In Vehicles in California.

Policy Discussion

What is not working:

- Discouraging repeat buyers and new car buyers
- Installing DCFC chargers as a substitute for while at home L2 chargers
- **Charger gentrification**
- Subsidizing new EVs to households who are not buying any new cars
- **Graduate students subsidies**

What can we try:

Charging infrastructure:

- Install public and private level 2 chargers to be used “while at home”
- Control cost of charging
- Subsidize chargers and electricity cost for renters

New Car market:

- Encourage high turnover (repeat buyers, leased cars)

Used Car market:

- Require and subsidize battery warranties
- Subsidize PEVs for lower income users (used, lease, rent)
- Shift from incentives aimed at changing behavior to incentives targeted at closing TCO gaps

Policy Discussion

What is not working:

- Discouraging repeat buyers and new car buyers
- Installing DCFC chargers as a substitute for while at home L2 chargers
- **Charger gentrification**
- Subsidizing new EVs to households who are not buying any new cars
- **Graduate students subsidies**

Policy Discussion

What can we try:

Charging infrastructure:

- Install public and private level 2 chargers to be used “while at home”
- Control cost of charging
- Subsidize chargers and electricity cost for renters

New Car market:

- Encourage high turnover (repeat buyers, leased cars)

Used Car market:

- Require and subsidies better warranty
- Subsidize PEVs for lower income users (used, lease, rent)
- Shift from incentives to change behavior to incentives to close TCO gaps

Policy Discussion

Shift to household level analysis and policies, instead of neighborhoods and communities.

Use communities for policy support and implementation not as a unit of analysis

Thank You

Gil Tal gtal@ucdavis.edu